

# COOLING TOWER FOR A PHARMACEUTICAL PROCESS COOLING WATER SYSTEM — CONSTRUCTION MANAGEMENT PROJECT DELIVERY

This month's B2B focuses on a new cooling tower to serve a pharmaceutical facility's new process water system. This tower will be a closed-loop, evaporative condenser to operate 24/7/365. The pharma company's design intent is to produce 100 tons of capacity while maintaining a clean and reliable system loop for the process equipment. The tower will have a floor-mounted end suction condenser water pump, and a second pump will serve as standby. The pumps shall each have a VFD to respond to the variation in flow to the 20-process equipment heat exchangers, each with two-way modulating automatic temperature control (ATC) valves. The tower shall also have two variable-speed, forced-draft fans to provide additional fan capacity should one fan fail.

The benefits of the closed-loop process cooling system include:

- A continuously maintained clean process/condenser water fluid via the closed-loop piping system;
- A closed-loop system that offers high-efficiency, clean, sustained performance;
- "Free cooling" operation during the condenser water heating season;
- Reduced energy consumption by operating the fan and process water pump at variable speed; and
- Redundancy in tower fans, condenser/process water pumps, and VFDs.

The design team shall be led by the HVAC engineer with structural, plumbing, and electrical consultants. The manufacturer engineer will provide guidance on the prepurchased process equipment. The project delivery method shall be construction management in accordance with the Construction Management Association of America (CMAA). The design team, along with the construction manager (CM) project manager, shall include the pharma capital project manager; building facility manager; and third-party commissioning (Cx) and testing, adjusting, and balancing (TAB) water balancing (CxTAB) consultant. The building's facility manager and her operating and maintenance (O&M) staff, including the building automation system (BAS) operator, will also participate in the CM process beginning at the conceptual design phase.

The design engineer directs the owner's in-house team and the CM's in-house team to *2016 ASHRAE Handbook – HVAC Systems and Equipment* Chapter 1, HVAC System Analysis and Selection, to determine the optimum cooling tower application for this special pharma equipment line. In addition, the owner and builder are also directed to Chapter 14, Condenser Water Systems, and Chapter 41, Evaporative Air-Cooling Equipment, of the handbook. The design team, owner's team, and CM should review the Cooling Technology Institute's (CTI's) cooling tower manual and the CTI certification criteria as part of the project delivery process. Also part of the development of the design intent, the project will take into account *2019 ASHRAE Handbook – HVAC Applications*, Chapters 37-44, covering building operation and management.

The design team and CM firm shall begin to come together at the Conceptual Phase of the design, working closely with the process equipment engineer and the facility management staff. The third-party CxTAB consultant will use the design team's Basis of Design to begin the initial training of the operations and maintenance (O&M) personnel as it pertains to the process water system tower and pumping strategy.

Electrical shall be 480/3/60 with prewired electrical power to a new BAS ATC panel and to fan motors furnished with disconnects at the cooling tower. This contractor will also furnish starters and disconnects to the VFDs and pump motors. The HVAC subcontractor's ATC subcontractor will work with the electrical subcontractor to interface the new process cooling tower system's ATCs, including the 20-piece process equipment to the existing BAS.

At the end of this first phase of design, the CM will provide the initial project estimate. At the end of the Design Development Phase, the CM will provide a guaranteed maximum price (GMP) for the job. During the Construction Phase, the O&M staff shall follow along with the subcontractors when the process water system is started up, water balanced for normal operation, and lead-lag sequenced under a tower fan or condenser water/process water equipment failure. This O&M staff will observe the CM's mechanical-electrical coordinator and automatic control subcontractor demonstrating the third-party CxTAB consultant's functional performance test. The building's BAS operator will also follow along with the design and construction process.

## **The CM team's HVAC subcontractor shall include the following during the shop drawing submittal phase:**

- Equipment submittals - A startup sheet - Troubleshooting sheets
- A cooling tower performance testing process - O&M manuals, parts, and lubricants - An ATC and energy management submittal including one complete ATC submittal integrating the manufacturer's cooling tower furnished ATC into an integrated overall ATC submittal.

## **The third-party CxTAB firm shall complete the following:**

- A TAB system flow diagram of the entire new condenser/process water system with gpm and pumps heads indicated at each piece of new equipment.
- A TAB system flow diagram of the entire supply and return water system, drawing upon data from the design engineer's hydraulic model with gpm and pressure drops at each piece of process cooling equipment and at major branch runouts.
- A commissioning functional performance test of the process system, including the cooling tower, circulating pumps, and process equipment.

Refer to The Facility File for additional information pertaining to completing the B2B test. **ES**



The design engineer shall check off the boxes from the company’s standardized field observation checklists that he will need to upload to his tablet computer prior to heading out to the construction site to complete his final HVAC inspection and punchlist. These checklists will be touchscreen-type. When the engineer returns to the office, or he sends the completed checklists via the internet to the office,

the completed checklists shall be automatically downloaded to the company’s computer server and placed in the “Project Closeout” section of the job’s folder. The completed checklists, along with associated digital photographs taken at the time of the field visit, will automatically be electronically sent to the following individuals and departments.

**TEAM CORRESPONDENCE DIRECTORY CHECKLIST**

*(Check the appropriate boxes)*

- Owner’s Capital Project Manager  Owner Representative
- IPD Lead Engineer  Construction Manager  General Contractor  Design-Build Contractor  Building Owner’s Facility Manager  HVAC Subcontractor  Owner’s BAS Operator
- Electrical Subcontractor  Plumbing Subcontractor  Fire Protection Subcontractor  ATC Subcontractor  Architect
- State Energy Department  Design Team Consultants  Piping Subcontractor  Sheet Metal Subcontractor  Third-Party CxTAB Consultant  Equipment Manufacturer’s Engineer  Building Inspector  Others: *(insert list)* \_\_\_\_\_

**HVAC CONTRACT SPECIFICATION CHECKLIST**

- Division 1 Project Closeout  Telecommunication Equipment
- Owner-Furnished Equipment  Structural  Electrical
- Plumbing  Fire Protection  HVAC  Infection Control
- ATC  Cooling Tower  Pumps  Fans  Air Handlers
- Variable Frequency Drives  Piping System  Sheet Metal System  TAB  Commissioning  Others: \_\_\_\_\_

**HVAC CONTRACT DRAWING INSTALLATION CHECKLIST**

- Telecommunication Equipment  Owner-Furnished Equipment
- Structural  Electrical  Plumbing  Fire Protection  HVAC
- Infection Control  ATC  Cooling Tower  Pumps  Fans
- Air Handlers  Variable Frequency Drives  Piping System
- Sheet Metal System  TAB  Commissioning
- Others: \_\_\_\_\_

**HVAC STARTUP CHECKLIST**

- Telecommunication Equipment  Owner-Furnished Equipment
- Structural  Electrical  Plumbing  Fire Protection
- HVAC  Infection Control  ATC  Cooling Tower  Pumps
- Fans  Air Handlers  Variable Frequency Drives  Piping System  Sheet Metal System  TAB  Commissioning
- Others: \_\_\_\_\_

**COMMISSIONING FPT (Functional Performance Test)**

- Telecommunication Equipment  Owner-Furnished Equipment
- Structural  Electrical  Plumbing  Fire Protection  HVAC System  Infection Control  ATC  Heating System  Chilled Water System  Condenser Water System  Cooling Tower
- Pumps  Piping System  Sheet Metal System  Equipment Room  Others: \_\_\_\_\_